MONTHLY WEATHER REVIEW,

JUNE, 1876.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In compiling the Review for June the following data have been made use of, viz: The weather charts constructed three times per day from the simultaneous observations taken at eighty-eight Signal Service and fourteen Canadian stations; monthly weather reports from four hundred and forty-five stations, classified as Voluntary Observers, Army Posts, Naval Hospitals, Canadian and Signal Service stations; special reports; reliable newspaper extracts; and Marine Records.

The principal meteorological features of the month have been: first, the absence of any extensive storm and the small number of severe winds; second, the unusually heavy rains in the South Atlantic States; third, the unprecedented high water in the Upper Missouri river and in the rivers of Oregon; fourth, the extensive occurrence of thunder-storms and the feeble auroral displays; fifth, the numerous local tornadoes.

BAROMETRIC PRESSURE.

In General.—The general distribution of barometric pressure during the month is shown by the isobars upon Chart No. I, from which it will be seen that the highest monthly mean is reported from Oregon, while the pressure was comparatively low in California. On the eastern side of the Rocky Mountains the pressure has averaged highest (30.03 to 30.06) on the South Atlantic coast, whence it has diminished regularly in all directions; to 29.99 on the Texas coast; to 29.91 in the St. Lawrence valley, and 29.77 in western Dakota. As compared with June, 1875, the pressures have been lower, and especially over the Lake region and Minnesota. As compared with June, 1874, the pressures have been about the same, except decidedly higher in the St. Lawrence valley and Canadian Provinces. The history of changes in pressure during the month is simply a record of a succession of high pressures in Oregon and on the South Atlantic coast, with continued attempts at the formation of areas of low pressure in the interior of the country. The connection between barometric changes on the Pacific coast and those in the interior of the continent has not been so apparent as it is in the winter months. The heating of the dry air over the western plains, and the consequent inflow of cold air from all sides, both from the mountains on the west and from British America on the northeast and the Gulf States on the southeast, has been well marked. The areas of low pressure have been, with one exception, ill-defined and not very permanent; those of high pressure have at no time passed centrally over our territory, but have made themselves felt only on the borders, showing that an area of one thousand miles square is not sufficient for the complete elucidation of the movements of the atmosphere. The heavy rain-fall upon the coasts of Georgia and South Carolina from the 11th to the 17th, and the gales a short distance off the coast, which were, however, scarcely felt at the Signal Service stations, were not accompanied by any barometric depression, so far as yet heard from.

Areas of High Pressure—No. I—Pressure was highest off the South Atlantic on the 1st and 2nd.

II—moved from the Rocky Mountains southeastward on the 3rd; it was over Indian Territory on the 4th; over the Western Gulf States on the 5th; over the Eastern Gulf States on the 6th, and on the 7th was merged into the rising barometer on the South Atlantic coast. Pressure continued highest off the Carolina coast on the mornings of the 8th, 9th, 10th and 11th.

III.—During the 10th pressure rose decidedly in the valley and Gulf of the St. Lawrence and in the Canadian Provinces, and extending southward along the coast was merged into No. II. At 7:35 a. m. of the 12th the high pressure extended from South Carolina to Cape Breton, being higher in the latter. On the 13th the highest pressure was in Nova Scotia and the barometer had fallen slightly in the Middle Atlantic States and the interior of the country. The pressure was on the 14th and 15th highest in Nova Scotia, but had, on the latter day, fallen decidedly, while it had risen slightly over the Middle Atlantic States. Pressure continued high from Cape Hatteras to Cape Breton on the 16th; it had on the 17th fallen somewhat in the Middle States, and continued highest in Nova Scotia, where it was also highest on the 18th and 19th. It rose in the South Atlantic States on the 19th and still more on the 20th, on the morning of which day it had fallen in Nova Scotia.

IV.—The high pressure that was on the 14th, 15th and 16th off the Pacific coast and the low pressure then central in Missouri and the Upper Lake region were followed on the 16th by a rapid rise in Manitoba and Dakota, with northerly winds, but on the 17th pressure again fell.

V.—The barometer rose with southerly winds on the 19th in the South Atlantic and Gulf States and at 7:35 a. m. of the 20th pressure was as high in Georgia as in Nova Scotia; it continued highest in the Eastern Gulf States on the mornings of the 21st, 22nd and 23rd, and over the Western Gulf States on the 24th. Although it had generally fallen somewhat, at 7:35 a. m., of the 25th, it was highest on the Gulf coast but still falling decidedly, the greatest fall being reported from the stations in the extreme Northeast; on the 26th and 27th pressure was highest in Florida and Eastern Gulf coast and was rising both there and over the Lakes; on the 28th it had risen in the Gulf States and Lake region but continued highest in the former; on the 30th it was high in Florida but had fallen in most of the Gulf States.

VI.—Northwest winds, rising barometer and generally lower temperatures prevailed on the 27th in the Lake region and on the morning of the 28th pressure was higher from the Missouri valley to Lake Ontario than it had been for the previous five days; on the 29th this high barometer was over Illinois and Missouri, after which it disappeared.

Areas of Low Pressure.—I.—This depression appears at 7:35 a. m. of the 1st central in northeastern Dakota and southerly winds prevailed from the Alleghanies to the Rocky mountains; by 4:35 p. m. the depression had moved northeastward beyond our stations and pressure had risen in Minnesota and the Missouri valley; brisk south winds were reported on Lake Superior; the course of the central depression is too uncertain to be published on Map I.

II.—On the 2d there was formed a slight depression in the Arkansas valley, between the regions of warm southerly and cold northerly winds; the depression extended eastward, but without forming a well marked trough or oval. On the 3d, at 7:35 a. m., a slight depression was located near Toledo, which was central at 4:35 p. m. over western Pennsylvania and progressing slowly eastward was on the morning of the 4th over the State of New York and disappeared over New England after 11 p. m. of that day. The position of the central track, as charted on map I, is liable to considerable uncertainty.

III.—On the 5th, while a cold west gale prevailed at the summit of Pike's Peak, warm southerly winds prevailed over the plains between the Rocky Mountains and the Mississippi, extending rapidly northward, with falling barometer, until, at 4:35 p. m., of the 6th, the lowest pressure was central over Nebraska and Dakota, while cool northeast winds, with rising barometer, had extended southward over the Upper Lakes, and west winds, with rising barometer, were reported from the Pacific coast. During the next 24 hours the pressure rose in the Atlantic States, but fell, with north and west winds, over the interior of the continent, and at 4:35 p. m., of the 7th, the lowest pressure was on the southwest border of Minnesota, whence it moved slowly eastward, and was, at 4:35 p. m. of the 8th, in western Wisconsin. During the subsequent night this depression disappeared on the Upper Lakes, where the barometer continued rather low.

IV.—At 11 p. m. of the 8th, northerly winds were reported from Dakota, but, during the 9th, barometer fell to the westward of our stations, and the region of southerly winds and falling barometer extended from Texas to southern Dakota, while easterly winds, and stationary or rising barometer prevailed in Manitoba and Lake Superior. By 11 p. m. of the 9th, the depression had extended northward along the west border of Minnesota, with cool northerly winds to the westward, but brisk and high south winds on the eastern side. During the 10th, this depression disappeared in British America, leaving only southerly winds over the Lake region.

V.—During the 12th, the barometer fell decidedly on the California coast, and, simultaneously, there formed in the interior of the Gulf States a slight depression, which was, at 11 p. m., central in northern Alabama. During the 13th the area of falling barometer extended over a large region, and on the 14th, at 7:35

a. m., local depressions were found in Georgia and Indian Territory. On account of its uncertainty the track of this depression, if it had any, is not given on Chart No. I.

VI.—This, the principal area of low pressure, began to be developed on the 15th in Arkansas. The pressure was then high on the Atlantic coast, and the depression extended northward until by 4:35 p. m. of the 16th, the central area had moved into northern Illinois; during this day severe local storms prevailed on the Lakes, and lighter storms and rains over nearly the whole country east of the Rocky Mountains. During the 17th the lowest pressure remained in the neighborhood of Lake Michigan, while the highest pressure continued on the east Atlantic coast, but diminished in the Southern States, and rain fell more abundantly, with southeast winds, throughout the United States. On the 18th the principal depression continued moving northward over Lake Superior, although a subsidiary local area of low pressure is traced to Lake Erie, and the barometer continued low, but rising over Wisconsin until 11 p. m. of the 19th.

VII.—On the 28th and 29th rain fell generally in the interior of Texas, several very heavy local rains being reported in the Red River valley; the region of heavy rain moved slowly northward over Indian Territory, and in advance of it the pressure fell decidedly over Kansas, Missouri, etc. At 4:35 p. m of the 30th an area of low barometer apparently extended from Colorado, eastward through northern Kansas and southern Missouri to Miss ssippi. During the evening of the 30th a very heavy snow storm prevailed on Pike's Peak, where for two days the pressure had been rapidly falling. The subsequent history of this depression and its sudden violence in the Lake region belongs to July.

TEMPERATURE OF THE AIR.

In General.—The isothermal lines on Chart No. II show the general distribution of the temperature for the month, from which it appears that, in comparison with the average of many years, the temperature has been above the mean in the St. Lawrence valley, New England, the Lower Lake region, the Middle and South Atlantic States, and, to a less extent, on the Pacific coast. It has been slightly below the mean in the Upper Lake region, and decidedly below in Minnesota, upper Mississippi and lower Missouri valleys, Ohio valley and Tennessee. In comparison with June, 1875, but slight changes are noticed, except the somewhat lower temperatures in the Gulf States. The temperature in the Gulf States, Tennessee and the Ohio valley during the past month has averaged from 2 to 5 degrees below that of June, 1874. The average temperature at the summit of Mt. Washington has been 48°, and at the summit of Pike's Peak 31°. In June, 1874, these temperatures were, respectively, 43° and 35°, and in June, 1875, 43° and 34°. The temperature on the Pacific coast is generally considered to have been higher than ever before known.

Maximum Temperatures.—Maximum temperatures exceeding 95° have been reported as follows: 98° at Augusta, Mobile, St. Marks; 96° at Breckenridge and Washington; 97° Charleston, Denver, Kittyhawk, Memphis, Tybee Island, Vicksburg and Yankton; 99° Corsicana, Jacksonville, Montgomery, Savannah and Wilmington; 100° Dodge City and Norfolk; 101° North Platte; 111° Fort Sully; 115° at several stations in Arizona.

Minimum Temperatures.—Temperatures below 45° have been reported as follows: 40° at Alpena, La Crosse and Santa Fe; 44° Boston, Milwaukee, Evanston, Portland, Me. and Wytheville; 33° Bismarck; 37° Breckenridge, Colorado Springs and Marquette; 28° Cheyenne; 43° Davenport, New London and Omaha; 38° Denver and Yankton; 41° Fort Sully, Dodge City, Dubuque and Eastport; 36° Duluth and Manhattan; 39° Escanaba and St. Paul; 32° Mt. Washington; 42° New Haven, Salt Lake City and Springfield; 34° Pembina.

Ranges of Temperature.—The greatest ranges that have been reported during the month are at Alpena, 50°; Bismarck, 60°; Breckenridge, Denver, Dodge City, Yankton, 59°; Cheyenne, 65°; Colorado Springs, 56°; Dubuque, Omaha, 51°; Duluth, Salt Lake City, 52°; Marquette, St. Paul, 53°; North Platte, 68; Manhattan, 68°; Pembina, 57°; Fort Sully, 70°. The smallest ranges have been at Cape Hatteras, 32°; Cape May, Montgomery, 38°; Charleston, 31°; Galveston, 24°; Indianola, 20°; Jacksonville, 33°; Kittyhawk, Memphis, Rochester, 39°; Lexington, Mobile, Toledo, 35°; Mt. Washington, Savannah, Vicksburg, 34°; New Orleans, 26°; Cape Lookout, 27°; Punta Rassa, 22°; Tybee Island, 27°.

Frosts are reported as follows: On the 1st, Bangor, Me., Westboro, Mass., destructive; 1st, 2nd and 8th, Orono, Me.; 1st, 2nd, 3rd, 4th, 6th, 11th, 14th and 21st, Portland, Me.; 1st, 16th, 17th and 18th, severe at Plattsmouth, Neb.; 2nd, light at Gardiner, Me., Auburn, N. H.; 3rd, Breckenridge, Minn.; heavy on 3rd and light on the 4th Platte county, Neb.; on the morning of the 4th at Fort Pembina, Fort Sully, D. T., Moorhead, Minn., Neillsville, Wis.; 6th, Traverse City, Mich.; 18th, Crawford county, Iowa; 19th, severe at Abingdon, Ill., and light at Muscatine, Iowa and Wooster, Ohio; 21st, Monticello, Iowa.

PRECIPITATION.

The distribution of rain and snow during the month is represented on chart No. III. A comparison of the average rain-fall for many years shows that an excess has fallen on the coast of the South Atlantic States, Indian Territory, the Upper Mississippi and Lower Ohio valleys. Small regions of deficiency are reported from Mississippi, the neighborhood of New York city and southern New England. In June, 1873, there was a decided excess throughout Tennessee and the Gulf States, in the eastern portions of South Carolina and also in the Ohio valley and the Northwest. In June, 1874, the regions of excess were the St. Lawrence valley, Eastern Gulf States, Upper Lake region, and especially Minnesota. In June, 1875 the regions of excess were New England, the Upper Mississippi valley, the Pacific coast, and especially the Lower Missouri and Ohio valleys. The rain-fall at Mt. Washington was 9.32 in., and at Pike's Peak 2.88 in; the greater part of the latter was snow.

Rainy Days.—The number of days on which rain fell, as reported by the Signal Service Observers, was, at the Atlantic coast stations from Norfolk to Wood's Hole, from 4 to 13. In New England, from 10 to 12, except 19 at Boston. In the Lower Lake region, from 13 to 22. In the Upper Lake region, from 15 to 22. In the Upper Mississippi valley, from 10 to 18. In the Lower Missouri valley, from 12 to 20. In the Southwest, from 8 to 11. In the Eastern Gulf States, 7 to 11. In Tennessee and the Ohio valley, 14 to 20. South Atlantic States, 9 to 18.

Cloudy Days—as reported by voluntary observers, average 6 in the South Atlantic States, 8 in New England, 4 in the Gulf States, and 10 in the Northwest and Upper Lake region.

Cloudless Days.—At Clarksville, Texas, 6 cloudless days are reported.

Foggy Days.—Fog has prevailed to a large extent along the entire coast of Maine, and an unusual amount is also reported southward to New London. At Mt. Desert, Me., 19 foggy days are reported, and the morning of the 22nd was the first clear one for four weeks.

Heavy Rains.—Especially heavy rains have been reported as follows: On the 3rd, a high wind and cloud burst near Seneca Lake, N. Y., covered an area of 4 square miles to an estimated depth of 2 feet of water; 3rd, near Shelburne, N. H.; 8th, Syracuse, N. Y., 8 in. in 3½ hours; 10th, Corning, Mo.; 12th, Austin, Tex.; 12th to 17th, Lenoir and Asheville, N. C., over 6 in.; 13th, Burlingame, Kan., 5 in. in 36 hours; 16th, Gainesville, Ga., and for 100 miles E. and S., causing damages of $1,000,000 and loss of 8 lives; 16th, Independence, Mo.; 16th and 17th, Mt. Solon, Va., 6 in.; 17th, Cumberland, Md., 3.30 in., Goldsboro, N. C., 5.60 in., Attaway Hill, N. C., 2 in. in 30 minutes, Lynchburg, Va., 2.50 in.; 18th, Nichols, N. Y., 2.85 in.; 19th, Utica, Wis.; 28th and 29th, Ringgold, Ohio, 3.25 in.; 29th, Baxter Springs, Kan., (from 5 a. m. 28th to 6 a. m. 29th,) 4.50 in.; 30th, Fort Larned, Kan., 1.14 in., Carbondale, Ill., 4.33 in.

Snows.—Snow is reported on the 1st at Fort Sanders, Wy. Ter.; 18th, Havana, Ill. and Independence, Iowa, and on the 30th at Pike's Peak.

Droughts.—At Newark, N. J., no rain fell from the 20th to close of month; 30th, at Freehold, N. J., corn was suffering; Ardenia, N. Y., latter part of month dry, and rain needed; North Hammond, N. Y., month dry, rain needed; Stapleton, N. Y., no rain during last ten days; Flushing, N. Y., month dry and hot; Palermo, N. Y., vegetation suffering for rain on the 7th; in the neigborhood of Dodge City, Kan., and Breckenridge, Minn., drought experienced during the former half of the month.

Hail-storms were reported as follows: 1st Iowa City, Iowa; 3rd, Belmont Farm, Tex.; 4th, Oneida, N. Y.; 7th, Wabash, Ind.; 11th, Morristown, Penn., Northport, Mich.; 12th, near Indianapolis, Ind; 16th, Milledgeville, Ky.; 17th, near Wabash, Ind.; 18th, Kenton, Ohio; 20th, Prospect Hill, Va., Ringgold, Ohio, Canton N. Y., Muskogee, Ill.; 22nd, near Columbiana, Ala., Laconia, Ind., and Keokuk, Iowa; 23rd, Lancaster, Ohio; 25th South Hartford, N. Y., Mendon and Fall River, Mass.; 26th, near Independence, Iowa, and Southington, Conn. At Pike's Peak the principal hail-storms were on the 19th, 27th, 28th, 29th, 30th,

RELATIVE HUMIDITY.

The relative humidity, as reported from the Signal Service stations, averages from 70 to 75 per cent. in the South Atlantic States, from 70 to 74 in New England, from 71 to 77 in the Upper Mississippi valley and the Upper Lake region, from 62 to 67 in the interior of the Middle States, from 64 to 67 in the Ohio valley, from 70 to 71 in Texas and from 71 to 83 on the Middle Atlantic coast. The highest average for the month is 88 at Mt. Washington. The lowest at the sea-coast stations is 64 at Norfolk. At the Rocky Mountain stations the averages, uncorrected for altitude, are 33 at Salt Lake City, 37 at Denver, 39 at Cheyenne, 43 at Colorado Springs, 47 at Santa Fe, and 64 at Pike's Peak.

WINDS.

Prevailing Winds.—The prevailing winds for the month are shown by the arrows on chart No. II. They have been south and southeast in the Gulf States, southerly from North Carolina to Massachusetts, southwest over the Lake region, Ohio valley and Missouri, northwest in Minnesota, Dakota and Nebraska.

Total Movement of the Air.—At the Signal Service stations the largest monthly movements are as follows: Pike's Peak, 13.021; Cape Lookout, 11.360; Dodge City, 11.333; Breckenridge, 10 769; Cape Hatteras, 9.512; Cape May, 9.276. The smallest total movements are: Salt Lake City, 3.570; Springfield, 3.567; Montgomery, 3.404; Morgantown, 3.380; Wytheville, 3.268; Albany, 3.219; Augusta, 3.105; Nashville, 2.935; Vicksburg, 2.906; Lynchburg, 2.367. The voluntary observer at Atlanta, Ga., reports 3.470.

Highest Winds.—Among the highest wind velocities reported at the Signal Service stations are the following: Yankton, 18th, NW., 40; Indianola, 18th, SE., 40; Long Branch, 27th, S., 40; Barnegat, 21st, S., 40; Escanaba, 17th, S., 40; Punta Rassa, —, E., 40; Salt Lake City, —, NE., 40; Charleston, 12th, SE., 41; Dodge City, 17th, SE., 41; Smithville, 17th, SW., 41; Breckenridge, —, N., 46; Denver, 3d, S., 48; Grand Haven, 26th, W., 48; Knoxville, 25th, SW., 48; North Platte, 23rd, N., 48; Evanston, 23d, SW., 48; Malone, 19th, SW., 48; Louisville, 23d, S., 52; Davenport, 6th, SW., 60; Mt. Washington, 18th and 22nd, and 24th, 26th and 28th, NW., 60; Pike's Peak, 6th, N., 66. A severe gale was reported off the Georgia coast on the 14th.

High Winds—generally attending hail-storms or tornadoes, are reported from volunteer stations, as follows: 3rd, Starkey, N. Y., destructive wind-storm; 6th, Corning, Mo., strong S. wind, Fort Sully, Dak., gale for 10 minutes, Davenport, Iowa, gale for 3 minutes; De Soto, Neb., heavy wind; Coalville, Utah, high wind; 8th, Starkey, N. Y.; 9th, Madison Barracks, N. Y., high wind; 11th, Ephrata, Pa., destructive wind; 18th, Kenton, Ohio, severe wind-storm; 18th, Blooming-grove, Penn.; 20th, Olive Furnace, Ohio, severe wind; 23rd, Milledgeville, Ky., violent wind, Alpena, gale for 15 minutes; 30th, Ellinwood, Kan., high wind.

Tornadoes—on the 7th and the 15th, tornadoes occurred near Dodge City, the former was quite severe; 23rd, Paris, Ky.; 24th, at Portage, Penn.; on the 25th, at 3:45 p.m., a tornado passed just east of Lenoir, N. C., where several houses were blown down; the storm passed from N.W. to S.E. On the 25th, about 4 p. m., a tornado or waterspout passed through Kingsbury, Hartford and Hebron, N. Y.; the width of the storm-track was about 200 yards, its duration at any point was 17 or 18 minutes—heavy hail-stones fell, of which 15 per cent. were one inch in diameter. At the same time with the preceding storm, a more violent one passed in nearly the same direction, 40 or 50 miles to the northward, passing into Vermont near Rutland. On the 26th, near Pueblo and Hard Scrabble cañon, Col., between 3 and 4 P. M., a very severe storm is reported, having a track about two miles wide; hail-stones, to the depth of 18 inches, were lying on the ground next day; it is noted that clouds had been collecting for two days previously, and that shortly before the storm they were seen to be rising from the neighborhood of Pike's Peak in huge black masses.

VERIFICATIONS.

Cautionary Signals.—Twenty-four Cautionary Signals have been displayed at the United States Signal Service stations, of which four were ordered too late, five were not justified, and nineteen were reported justified. Eighty-five additional cases were reported, in which winds passed the limit of 25 miles per hour, but most of them were of a local and temporary nature of these winds, for which Cautionary Signals were not required.

Probabilities.—A comparison of the published tri-daily Probabilities with the weather of the succeeding 24 hours gives 82.3 as the general average per centage of verifications; the per centage for the separate districts are as follows: New England, 83.9; Middle States, 87.0; South Atlantic States, 82.3; Eastern Gulf States, 81.2; Western Gulf States, 84.6; Tennessee and Ohio valley, 80.0; Lower Lake region, 82.6; Upper Lake region, 79.7; Upper Mississippi valley, 81.0; Lower Missouri valley, 82.4. The per centages for the separate meteorological elements were—for temperature, 83.1; wind, 86.3; weather, 84.2; barometer, 76.3.

NAVIGATION.

Stage of Water.—The highest and lowest readings on the river gauges are given in the table on Chart No. III, from which it will appear that the rivers were lowest during the latter portion of the month at Shreveport and St. Paul, but were highest at that time at Leavenworth, Pittsburgh and St. Louis. The Missouri river rose above "danger line" at a few stations between Leavenworth and St. Louis. The Mississippi was above "danger line" during the first part of the month in the neighborhood of Vicksburg. Re-

ports from Fort Benton show that throughout the month the Missouri was higher, perhaps, by four feet than was ever before known, which was attributed, by the observer at that place, to the unusual quantity of melting snow. The changes in the river below Yankton seem, however, not to have been, as yet, materially affected by the high water of the Upper Missouri, but were almost entirely due to the local rains in the Northwest; the rise due to the melting snows of the Rocky mountains will probably affect the lower river during July. The melting snows have caused similar extraordinary floods in Oregon.

Freshets.—The heavy rains that occurred in South Carolina and Georgia during the middle of the month gave rise to one of the highest stages of water on record at Savannah, and probably thoughout that region. The observer at Gainesville reports eight lives lost and damage to the extent of $1,000,000. The observers in Kansas report waters high in consequence of excess of rain. The observer at Corning, Mo., reports that destructive floods followed heavy rains. The observer at Asheville, N. C., reports on the 17th a great freshet in the French Broad river, and on the same date floods are reported from Lenoir, N. C. The observer at Neillsville, Wis., reports the extreme rise of Black river this spring eight feet.

Ice in Lakes and Rivers.—The observer at Ashland, Wis., reports that the navigation of Lake Michigan was interfered with by ice up to the 14th. Lake Superior, at Duluth, was obstructed by ice until the 25th; the harbor was clear on the 28th.

WATER TEMPERATURES.

The table on Chart No. II gives the maximum and minimum temperatures of the water near the bottoms of rivers and harbors. The lowest minima temperatures reported are 40° at Marquette and Eastport; 32° at Duluth; 48° at Burlington; 50° at Portland, Me. The highest maxima are 92° at Punta Rassa; 90° at Key West; 89° at Jacksonville and Norfolk; 85° at Montgomery and Augusta; 84° at Charleston and Mobile; 83° at Nashville. The largest ranges of temperature are 24° at Burlington; 17° at Omaha, New York, Keokuk and St. Paul; 16° at New London, Pittsburgh and Norfolk; 14 at Alpena, Augusta, Leavenworth and Wood's Hole. The least ranges are 7° at Detroit and St. Marks; 6° at St. Louis; 5° at Chicago, Milwaukee, Mobile and Savannah; 4° at Eastport and 3° at Wilmington.

ATMOSPHERIC ELECTRICITY.

Aurora.—Auroras have been faint, ill-defined, and often the observers have been doubtful as to the true nature of the phenomena. They are reported as follows: On the 3rd and 4th, at Corning, Mo.; 7th, Eastport, Me.; 10th, Litchfield, Mich., Fort Sully, D. T.; 11th, Duluth, Minn.; 12th, Dodge City, Kan., Pike's Peak, Col.; 13th, Pike's Peak, Col.; 18th, Pike's Peak, Col.; 23rd, Cleveland, Ohio, Eastport, Me.; 26th, Eastport, Me.; 27th, Le Roy, Wis., Malone, N. Y.; 29th, Abington, Ill., Carthegena, Ohio, Duluth, Minn.; 30th, Eastport, Me.

Telegraphic Ground Currents—were noted on the 15th at Colorado Springs; 3rd and 27th, at Philadelphia; 16th, 27th and 28th, at Pike's Peak; 17th, 23rd and 28th, at Santa Fé.

Lightning.—In order to obtain an approximate idea of the number of thunder-storms during the month, a count has been made of every case recorded at the 445 stations of lightning or thunder, whether near to or distant from the station; by including silent or distant lightning, it is presumed that the record for each station may be assumed to represent all cases that occur within a radius of fifty miles, and although in many instances the same storm having been observed at several stations will therefore be counted more than once, yet, on account of the fragmentary nature of most records, it is safe to presume that the sum total for the whole country, which is 1,344, is below rather than above the truth. The chronological distribution of these cases is given in the following statement: On the 1st, 38: 2nd, 40; 3rd, 53; 4th, 37; 5th, 7; 6th, 34; 7th, 27; 8th, 25; 9th, 58; 10th, 82; 11th, 64; 12th, 47; 13th, 23, 14th, 47; 15th, 39; 16th, 34; 17th, 24; 18th, 15; 19th, 24; 20th, 53; 21st, 43; 22nd, 39; 23rd, 67; 24th, 63; 25th, 96; 26th, 68; 27th, 84; 28th, 41; 29th, 39; 30th, 33. The geographical distribution is shown in the following statement: For the Atlantic and Gulf States—Maine, 37; New Hampshire, 28; Vermont, 33; Massachusetts, 56; Rhode Island, 2; Connecticut, 22; New Jersey, 32; Delaware, 7; Maryland, 24; District of Columbia, 8; Virginia, 38; North Carolina, 52; South Carolina, 9; Georgia, 29; Florida, 22; Alabama, 17; Mississippi, 46; Louisiana, 41; Texas, 18. For the Appalachian region—New York, 110; Pennsylvania, 40; West Virginia, 14; Kentucky, 22; Tennessee, 56. For the interior—Ohio, 74; Indiana, 38; Illinois, 91; Iowa, 111; Missouri, 19; Arkansas, 6. For the western plateau—Nebraska, 43; Kansas, 65; Indian Territory, 3; Wyoming Territory, 1; Colorado, 11; New Mexico, 21. For the northern boundary—Michigan, 38; Wisconsin, 31; Minnesota, 11; Dakota, 22; Montana, 1. For the Pacific slope—Idaho, 4; Nevada, 4; Utah, 1.

OPTICAL PHENOMENA.

Mirage.—This phenomennon was observed on the 6th, 7th and 29th at New London, Conn.; 10th, Sandy Hook, N J.; 19th and 20th, Ellinwood, Kan.

Solar Halos have been observed on the 1st in R. I.; 2d, Ga., Wis., Va., Ill.; 3d, R. I., Ga.; 4th, Ga.; 5th, Conn., N. J.; 6th, Mich., Col.; 7th, Me., Ohio, Wiss., Penn., Nev., Ill.; 8th, Ill., Me., Neb., N. Y., N. J.; 9th, Mich., N. Y., Wis., Kan.; 10th, Ohio, Utaw, N. J., Ga., Nev.; 11th, Kan., Ala.; 12th, N. Y., Ohio, La.; 13th, Mich., N. Y.; 14th, Iowa, N. H., N. Y.; 15th, Me., N. Y., Ohio; 16th, N. Y., Ohio; 17th, Del., N. J.; 18th, Dak.; 19th, N. Y., N. C., Ga.; 20th, Me.; 21, Ill., Iowa, Ohio, Wis., N. M., N. C.; 22d, Miss., N. Y., Ohio, Iowa, Tex.; 23d, N. Y.; 24th, Ga.; 25th, N. Y., Ohio, Wis., N. J.; 26th, Ohio, Neb.; 27th, Ill.; 28th, N. H., Me., Fla.; 29th, Ind., Me., N. Y., Ohio, Iowa, Ga.; 30th, Ill., Iowa, Mich., N. Y., Ohio, Penn., Me., Minn., N. C.

Lunar Halos have been observed on the 1st in Ga., Mich., Wis. Ind. T., Va., Ill.; 2d, Ohio, S. C., Ill., Mich., Va, W. Va., N. Y., Miss.; 3d, Ill., N. Y., N. C., N. J.; 4th, Iowa, Ill.; 5th, Ill., N. C.; 6th, Ill., N. C.; 7th, Ky., N. H., N. Y., N. C., Nev.; 8th, N. Y., N. C.; 10th, N. J., Conn., Mich., N. Y.; 11th, Kan., 14th, Me.; 15th, Conn.; 24th, N. C.; 25th, Iowa, Wis., N. J., Ga., Kan., Tenn., N. C., Ohio; 26th, Mass., N. J., Ga., Fla., Kan.; 27th, N. J., Wis., Kan., N. Y.; 28th, Ill., Iowa, Mass., Fla., Tenn., Ala., Ga.; 29th, Ill., Iowa, Penn., Va., S. C, N. C., Kan., Fla., Tenn., Ga., Miss.; 30th, Iowa. N. H., Penn., Wis., N. Y., Ill., N. C., Miss.

MISCELLANEOUS PHENOMENA.

Zoological.—Swallows appeared on the 8th at Mt. Washington, N. H.; returned on the 4th to Coalville, Utah. *Cuckoos* first appeared on the 2d at West Charlotte, and on the 10th at Strafford, Vt. *Colorado Beetles*, on the 20th, appeared at Dumbarton, N. H; 9th, New London, Conn.; 20th, Florida, Mass.; 12th, Fall River, Mass.; abundant during month near Detroit and doing much damage at Litchfield, Mich.; 4th at Auburn, and 11th at Contoocookville, N. H.; numerous at Ardenia, N. Y., Tarentown, Penn., and Embarrass, Wis. *Grasshoppers* at Pembina, D. T., but few appeared during the month; at Las Vegas, N., M., appeared 19th; Virginia City, M. T., 30t hnumerous throughout Territory, 27th began to fly; June 28th, a letter from Windon, Cottonwood co., Minn., states that every grasshopper examined is troubled by a red-fly parasite; they are rapidly dying, and probably not a single one will survive to lay its eggs. A similar statement has been made by Dr. Bell, of Colorado Springs, who states that flocks of grasshoppers, in various parts of the country, are suffering from the attacks of this parasite; and Mr. Thomas Belt, the entomologist, advises that the infected insects be widely distributed, so as to check the increase of grass-hoppers. *Crickets* heard on the 2d at Contoocookville, N. H. *Katy-Dids* first seen on the 30th at Gilmer, Tex. *Tobacco Worms* appeared on the 25th at Benettsville, Ky. *Gooseberry and Currant Worms* destructive on the 6th at Shellburne, N. H. *Locusts* first seen on the 29th at Gilmer, Texas. *Fire-flies* first seen on the 11th at Frechold, N. J.; 7th, Monticello, Iowa, and Decatur, Ill.; 3d, Morgantown, W. Va.; 25th, Afton, Iowa; 6th, Cornish, Me.; 1st, Northport, Mich.; 8th, Palermo, N. Y., 11th, Flushing, N. Y.; 2d, Wooster, Ohio; 17th, Woodstock, Vt.; 5th, Salem, W. Va.; 9th, Embarrass, Wis. *Tree Toads* first heard on the 9th at Monticello, Iowa.

Botanical.—Apple trees in bloom on the 7th at Standish, Me.; 4th, Florida, Mass., and Shelburne, N. H.; 1st, Strafford, Vt. *Lilacs* in bloom on the 4th at Shelburne, N. H; 2d, Palermo, N. Y. *Locust trees* in bloom on the 11th at Palermo, N. Y. *Cotton* in bloom on the 9th at Monticello, Ark.; crop "promising" at La Grange, Tenn.; crop looks well at Clarksville, Tex. *Catalpa* in flower on the 7th at Peroria, Ill. *Dahlias* in bloom on the 10th at Hot Springs, Ark. *Syringa* in blossom on the 5th at Southington, Conn. *Green Peas* ripe 20th at Jacksonburg, Ohio; 7th, Abington, Ill. *Cherries*—May cherries ripe on the 19th at Jacksonburg, Ohio; May Dukes ripe on the 7th at Fallston, Md.; ripe 13th at Abington, Ill.; 17th, Ft. Madison, Iowa; 8th, Vineland, N. J. *Currants* ripe on the 21st at Jacksonburg, Ohio. *Raspberries* ripe on 15th at Abington, Ill.; 23d, Ft. Madison, Iowa; 25th, Burlingame, Kas. *Blackberries* in bloom on the 24th at Florida, Mass.; 12th, Palermo, N. Y. *Strawberries* in bloom on the 1st, and ripe on the 23d, at West Charlotte, Vt.; ripe on the 5th at Abington, Ill.; 1st, Ft. Madison, Iowa; 15th, Shelburne, N. H. *Gooseberries* ripe on the 10th at Benettsville, Ky. *Whortleberries* in bloom on the 1st at Auburn, N. H. *Roses* in bloom on the 2d at Independence, Iowa. *Wheat*—harvest began on the 20th at Havana, Ill., and on the 23d at Carlisle, Penn.; crop very fine at Litchfield, Mich.; ripe on 22d at Vineland, N. J.; wheat, oat and barley crops all in at Clarksville, Tex.; winter wheat harvested on the 26th at Jacksonburg, Ohio; wheat is ripening, fair crop of oats and grass, light crop of fruit on the 30th at Ruggles, Ohio; harvest of winter barley

began 19th at Jacksonburg, Ohio. *Corn* in silk on the 27th at Abington, Ill.; ripe on the 16th at New Orleans, La.; crop "promising" at La Grange, Tenn., Clarksville and Melissa, Tex. *Grasses—red clover* in bloom on the 19th at Abington, Ill.; crop promising at Melissa, Tex.; *timothy* in bloom on the 21st at Abington, Ill. *Chestnut trees* in bloom on the 26th at Abington, Ill.; horse chestnuts in bloom on the 1st at Auburn, N. H.

Forest Fires—are reported near Freehold, N. J.

Polar Bands—were observed on the 6th at Wilmington, N. C.; 9th, Freehold, N. J.; 20th, Vicksburg, Miss.; 10th and 24th, Guttenberg, Iowa; 5th, Fayette, Miss.; 28th and 29th, Carthagena, Ohio; 24th, Wytheville, Va.

Meteors—are reported on the 2nd, in Ill.; 8th, Ohio; 9th, Ill.; 10th, Ill., N. C.; 11th, N. M., N. Y.; 16th, La., Miss.; 18th, Dodge City, Kan., and Ellsworth, Kan.; 19th, Ohio; 20th, Ind., Ky.; 21st, Mich., Ga., N. Y.; 23rd, Tenn., R. I.; 24th, Iowa, Md.; 25th, La., Ill., Iowa; 26th, Mass., Ohio; 28th, Ind. Ter., Wis.

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